(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 328 141 B1**

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **15.12.93**

(51) Int. Cl.5: **G11B 5/86**, G11B 5/09, G11B 20/10

(21) Application number: **89102357.4**

(22) Date of filing: **10.02.89**

(54) Recording and reproducing apparatus.

(30) Priority: **10.02.88 JP 29241/88**
08.03.88 JP 54269/88
11.03.88 JP 58756/88
31.03.88 JP 80844/88
31.05.88 JP 133339/88
31.05.88 JP 133340/88
29.06.88 JP 161744/88

(43) Date of publication of application:
16.08.89 Bulletin 89/33

(45) Publication of the grant of the patent:
15.12.93 Bulletin 93/50

(84) Designated Contracting States:
DE FR GB NL

(56) References cited:
EP-A- 0 224 929
EP-A- 0 297 242
WO-A-85/02293
AU-B- 536 261

Patent Abstracts of Japan, unexamined applications, E Section, vol. 3, no. 131, October 31, 1979, THE PATENT OFFICE JAPANESE GOVERNMENT, page 74 E 148

PATENT ABSTRACTS OF JAPAN; UNEXAMINED APPLICATIONS; P field, vol. 11, no. 5, January 8, 1987, THE PATENT OFFICE JAPANESE GOVERNMENT, p 90 P 533

PATENT ABSTRACTS OF JAPAN; unexamined applications; P field, vol. 11, no. 129, April23, 1987, THE PATENT OFFICE JAPANESE GOVERNMENT, p 71 P 570

(73) Proprietor: **MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.**
1006, Oaza Kadoma
Kadoma-shi, Osaka(JP)

(72) Inventor: **Shimada, Hiromichi**
118-303, Kaminoshima Nogami
Amagasaki-shi Hyogo-ken(JP)

(74) Representative: **Morgan, James Garnet et al**
Manitz, Finsterwald & Rotermund
Patentanwälte
Postfach 22 16 11
D-80506 München (DE)

EP 0 328 141 B1

Description

This invention relates to a recording and reproducing apparatus, such as a digital audio tape recorder referred to as a DAT recorder.

Conventional DAT systems generally have problems in direct recording of digital audio signals. Such direct recording is referred to as a digital copying process. Form the standpoint of copyright, it is desirable to limit the number of generation of copied digital audio information. In some cases it is desired that the limitation on the digital copying process is flexible.

EP-A-0 297 242 discloses a method for controlling a recording and reproducting system with record restricted function wherein a restriction flag having two bits is derived from an input signal in order to determine whether direct copying of the input signal is restricted or free. If direct copying is restricted, the input signal will be encoded and then it will be recorded together with a new restriction flag which indicates that the recorded signal is encoded. During the encoding process the encoder uses a self identification signal.

Upon reproduction, the encoded signal is decoded and in order to provide a correct reproduction, the decoder receives the same identification signal as the encoder has used for encoding.

If an encoded signal is to be recorded again, the restriction flag is detected and indicates that this signal was already copied. In this case, a second copy thereof is inhibited.

This method therefore uses two different signals, i.e. the identification signal for controlling the encoding and decoding process and the restriction flag for controlling the inhibition or allowance of a further copying process.

AU-B-536 261 describes a method for protecting a transmitted broadcast program from unauthorized recording. Therefore a corresponding protection code is added to the signal to be transmitted prior to transmission.

If this transmitted signal is received and is to be recorded by a user, the protection signal is compared with a previously stored signal which indicates that the user is authorized to obtain a copy of the transmitted signal by recording. If the protection signal agrees with the previously stored signal, recording is automatically allowed. On the other hand, when the protection signal disagrees with the previously stored signal recording is automatically inhibited.

Thus a signal which is inhibited from being copied cannot be copied even for the first time and a signal the copying of which is allowed can be copied independently of the number of copies previously made.

WO-A-85/02293 discloses a method for protecting a film which is recorded on a cinematographic or a video carrier against piracy. Therefore a marking signal is provided in the soundtracks of the original carrier. During a first copying and recording process, i.e. recording a master videotape, a first coded message is recorded in the soundtracks of the recording medium. During a second copying and recording process, i.e. producing a authorized slave videotape, a second coded message is added.

During reproducing such an authorized slave videotape the mark signal as well as first and second coded messages are detected and reproducing of the film recorded on this tape is enabled. If an authorized slave videotape is copied the coded messages are either erased or deteriorated. Thus, a film cannot be reproduced from an unauthorized copy of an authorized slave videotape because the coded messages are missing or cannot be detected due to the deteriorations thereof or by identifying such deteriorated coded messages.

The allowance and the inhibition of the copy are controlled by detecting a natural deterioration such as an edge variation in the first and second message codes caused by the copying process. However, if a high performance tape and high performance vidotape recorder which provide only a small natural deterioration are used, the control of the allowance and the inhibition of the copy tends to be unstable.

EP-A-0 224 929 discloses another method for preventing unauthorized dubbing of a recording signal which contains a dubbing protection bit. If this protection bit is set during dubbing the master tape, a dubbing or recording of the signal is prevented by the set bit. During reproducing such a signal it is checked, whether the protection bit is set or not and in case the protection bit is set, a dubbing protection circuit inhibites recording of the signal.

Therefore, the object of the present invention is to provide a new and improved method for controlling a recording and reproducing apparatus for a digital signal or a digitized analog signal transmitted between reproducing and recording devices which can suitabely limit a digial copying process.

This object is achieved in the invention by the method according to claim 1.

In accordance with the invention a digital signal recorded on a recording medium is provided in a first format comprising at least a copy control signal, which contains the information whether a direct copy of the digital signal is to be inhibited or whether a certain number of generations of copies is to be allowed. The digital signal is recorded onto the recording medium within a second format comprising a copy control subcode signal which is

derived in accordance to the copy control signal. During reproduction a new copy control signal is generated according to the copy control subcode signal and outputted together with the reproduced digital signal. Upon recording, the control subcode signal is detected and checked whether recording is to be allowed or inhibited. When direct copying is to be allowed, a new copy control subcode signal is generated in accordance with the copy control signal and the new copy control subcode signal is recorded together with the digital signal to be copied.

In this way, it is possible to determine or to limit the number of times direct copying of a digital signal is allowed. Thus, even if a digital signal contains a copy control subcode signal which indicates that copying is inhibited, recording of such a reproduced digital signal may be possible for private use. Furthermore it is possible to limit the generation of copies to a predetermined number.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is diagrams showing the format of a digital audio signal used in a DAT system.

Fig. 2 is diagrams showing a recording format used in a DAT system.

Fig. 3 is a block diagram of a DAT system according to a first embodiment of this invention.

Fig. 4 is a flowchart of a portion of a program controlling the microcomputer of Fig. 3.

Fig. 5 is a flowchart of a portion of a program controlling a microcomputer in a second embodiment of this invention.

DESCRIPTION OF THE FIRST PREFERRED EMBODIMENT

Fig. 1 shows the format of a digital audio signal used in a DAT system according to a first embodiment of this invention.

It should be noted that a signal format and a recording format in the first embodiment of this invention are basically similar to a conventional DAT signal format and a conventional DAT recording format but are differ from the latters in some points which will be described later.

As shown in Fig. 1(a), during a period of sampling of an analog signal, a pair of left-channel and right-channel subframes of a digital audio signal are formed. As shown in Fig. 1(b), each of the subframes has 32 time slots or sequential bits numbered from "0" to "31". Specifically, each subframe includes a 4-bit sync signal, 4-bit auxiliary data, 20-bit audio data, a validity flag "V", a user data "U", a channel status "C", and a parity bit "P".

A channel status will be taken as an example. As shown in Fig. 1(c), the bits "C" of 192 successive subframes form a channel status block having 192 bits numbered from "0" to "191". In the channel status block, bit "0" to bit "5" are control bits representing a use and also representing whether or not a digital copy is allowable. In the control bits, as shown in Fig. 1(d), the bit "2" which corresponds to the third bit of the channel status represents whether or not a digital copy is allowable. Specifically, the bit "2" equal to logic "1" represents that a digital copy is allowable. The bit "2 equal to logic "0" represents that a digital copy is inhibited.

In the channel status block, bit "8" to bit "15" form a category code. As shown in Fig. 1(e), the category code generally represents a type of an apparatus from which the related digital audio signal is outputted. As will be made clear hereinafter, bit "14" of the category code is used to control a copying process. It should be noted that, in conventional systems, bit "14" of a category code is unused and is constantly logic "0".

Fig. 2 shows a recording format used in the DAT system. As shown in Fig. 2(a), one recording track formed on a magnetic tape has a PCM (pulse code modulation) region in a central portion of the magnetic tape. In the PCM region, PCM data and a main ID (identification) are recorded. The PCM data are generated by coding an audio signal. The main ID is used to reproduce the PCM data. The PCM region has 128 blocks. As shown in Fig. 2(b), one block of the PCM region has 288 bits.

As shown in Fig. 2(c), the main ID includes a format ID, and sections ID1-ID7 forming pairs recorded in alternate blocks. As shown in Fig. 2(d), the format ID equal to logic "00" represents that the DAT is an audio recorder. The section ID6 represents whether or not a digital copy is allowable. Specifically, the section ID6 equal to logic "00", "01", or "11" represents that a digital copy is allowable. The section ID6 equal to logic "10" represents that a digital copy is inhibited. It should be noted that, in conventional systems, the section ID6 equal to logic "01" or "11" is undefined in respect of a digital copy.

With reference to Fig. 3, a DAT system according to a first embodiment of this invention includes an analog input terminal 1 via which an analog audio signal is applied to an analog-to-digital (AD) converter 2. A digital audio signal is fed via a digital input terminal 3 to a digital demodulator 4. A swich 5 selects one of digital output signals from the devices 2 and 4 and feeds the selected digital signal to a signal processor 6 in accordance with a control signal supplied from a microcomputer 27.

The signal processor 6 acts on the input digital signal through various processes such as an inter-

leaving process, an addition of error correction codes, and an addition of an output signal from a subcode encoder 13 described hereinafter. An output digital signal from the signal processor 6 is applied via a recording amplifier 7 to a recording magnetic head 8 and is recorded into a magnetic tape 9 by the magnetic head 8. The signal processor 6 also has a function of inhibiting the recording of its output signal into the magnetic tape 9. This function is enabled and disabled in response to an output signal from the microcomputer 27. For example, the inhibition of the signal recording is performed by cutting off the application of the output signal from the signal processor 6 to the recording amplifier 7.

A channel status decoder 10 extracts a channel status (see Fig. 1(c)) from an output signal of the digital demodulator 4. The microcomputer 27 receives an output signal from the decoder 10 which represents the channel status.

A subcode encoder 13 receives an output signal from the microcomputer 27 which represents the section ID6 of the main ID. The subcode encoder 13 generates subcodes including the section ID6. The subcodes are transferred from the encoder 13 to the signal processor 6.

An operating section 14 includes a recording switch, a reproducing switch, and a selection control switch for determining which of an analog audio signal and a digital audio signal inputted via the input terminals 1 and 3 is selected. The selection control switch of the operating section 14 is changeable between an "analog" position and a "digital" position. As will be made clear hereinafter, when the selection control switch assumes the "analog" position and the "digital" position, an analog audio signal and a digital audio signal are selected respectively. Output signals from the operating section 14 are applied to the microcomputer 27.

A magnetic head 28 reproduces a digital signal from the magnetic tape 9. The reproduced digital signal is transmitted to a signal processor 18 via a reproducing amplifier 17.

The signal processor 18 acts on the reproduced digital signal through various processes such as an error correction process and a deinterleaving process. An output signal from the signal processor 18 is applied to a digital-to-analog (DA) converter 19 and a digital modulator 25. The DA converter 19 transforms the output signal from the signal processor 18 into a corresponding analog signal applied to an analog output terminal 20. The digital modulator 25 generates a digital signal in the format of Fig. 1 in accordance with the output signal from the signal processor 18 and with an output signal from a channel status encoder 23. The digital signal generated by the digital modulator 25 is applied to a digital output terminal 26.

A subcode decoder 21 extracts subcodes from an output signal of the signal processor 18. The derived subcodes include a section ID6 of a main ID. The microcomputer 27 receives an output signal from the subcode decoder 21 which represents the subcodes.

The channel status encoder 23 receives an output signal from the microcomputer 27 which represents a channel status. The device 23 encodes the output signal from the microcomputer 27.

The microcomputer 27 includes an input/output (I/O) port 27A, a random access memory (RAM) 27B, a program counter 27C, a read only memory (ROM) 27D, an arithmetic and logic unit (ALU) 27E connected via a system bus 27F. The microcomputer 27 also includes a clock generator 27G feeding clocks to the devices 27A-27E. The I/O port 27A outputs signals to the switch 5, the signal processor 6, the subcode encoder 13, and the channel status encoder 23. The I/O port 27A receives signals from the channel status decoder 10, the operating section 14, and the subcode decoder 21.

The microcomputer 27 operates in accordance with a program stored in the ROM 27D. Fig. 4 shows a flowchart of a portion of this program.

As shown in Fig. 4, the program advances from a point "A" to a step 31 which determines whether or not the recording switch of the operating section 14 is depressed. When the recording switch is depressed, the program advances to a step 32. When the recording switch is not depressed, the program advances to a step 39.

The step 32 determines whether or not the selection control switch of the operating section 14 is in the "digital" position. When the selection control switch is in the "digital" position, the program advances to a step 33. When the selection control switch is not in the "digital" position, that is, when the selection control switch is in the "analog" position, the program advances to a step 37.

The step 33 controls the switch 5 to select an output signal from the digital demodulator 4. Accordingly, when the selection control switch of the operating section 14 is in the "digital" position, a digital audio signal inputted via the digital input terminal 3 is selected. In addition, the step 33 derives the current logic states of bit "2" and bit "14" of the channel status by referring to an output signal from the channel status decoder 10.

A step 34 following the step 33 determines whether or not bit "2" and bit "14" of the channel status are logic "0" and logic "1" respectively. When bit "2" and bit "14" are logic "0" and logic "1" respectively, the program advances to a step 38. When bit "2" and bit "14" are not logic "0" and

logic "1" respectively, that is, when bit "2" and bit "14" are logic "0" and logic "0", logic "1" and logic "0", or logic "1" and logic "1" respectively, the program advances to a step 35.

The step 38 controls the signal processor 6 to inhibit the recording of an output signal from the signal processor 6 into the magnetic tape 9. Accordingly, when bit "2" and bit "14" of the channel status are logic "0" and logic "1" respectively, the recording of the output signal from the signal processor 6 is inhibited. After the step 38, the program advances to a point "B".

The step 35 sets a section ID6 of a main ID in accordance with bit "2" and bit "14" of the channel status. Specifically, the section ID6 is set to logic "10" when both of bit "2" and bit "14" are logic "0". The section ID6 is set to logic "00" when bit "2" and bit "14" are logic "1" and logic "0" respectively. The section ID6 is set to logic "01" when both of bit "2" and bit "14" are logic "1". After the step 35, the program advances to a step 36.

The step 37 controls the switch 5 to select an output signal from the AD converter 2. Accordingly, when the selection control switch of the operating section 14 is in the "analog" position, an analog audio signal inputted via the analog input terminal 1 is selected. In addition, the step 37 sets a section ID6 of a main ID to logic "00". After the step 37, the program advances to a step 36.

The step 36 sets a recording mode by which the recording of an output signal from the signal processor 6 into the magnetic tape 9 is enabled. After the step 36, the program advances to the point "B".

The step 39 determines whether or not the reproducing switch of the operating section 14 is depressed. When the reproducing switch is depressed, the program advances to a step 40. When the reproducing switch is not depressed, the program jumps to the point "B".

The reproducing system including the magnetic head 28 is activated in response to the depression of the recording switch of the operating section 14 in a known way.

The step 40 derives the state of the section ID6 of the main ID of the reproduced signal by referring to the output signal from the subcode detector 21. In addition, the step 40 sets bit "2" and bit "14" of a new channel status in accordance with the derived section ID6. Specifically, both of new bit "2" and bit "14" are set to logic "1" when the section ID6 is logic "00". Both of new bit "2" and bit "14" are set to logic "0" when the section ID6 is logic "01". New bit "2" and bit "14" are set to logic "0" and logic "1" respectively when the section ID6 is logic "10".

A step 41 following the step 40 outputs the new channel status to the channel status encoder 23. The channel status encoder 23 generates a signal representing the new channel status in the format of Fig. 1(c) which includes new bit "2" and bit "4" given by the step 40. The digital modulator 25 combines the output signals from the signal processor 18 and the channel status encoder 23 into a digital signal in the format of Fig. 1. The digital signal generated by the digital modulator 25 is outputted via the digital output terminal 26. After the step 41, the program advances to the point "B".

General operation of the DAT system of this embodiment will be described hereinafter. When digital recording of a digital audio signal reproduced from a compact disk or a DAT software tape is required, the digital input terminal 3 is subjected to a digital audio signal. In addition, the recording switch of the operating section 14 is depressed and the selection control switch of the operating section 14 is moved to the "digital" position. Accordingly, an output signal from the digital demodulator 4 is selected and is passed to the signal processor 6 by the switch 5. In the case of a digital audio signal reproduced from a compact disk or a DAT software tape, a bit "2" of a channel status is logic "0" representing the inhibition of digital recording, and a bit "14" of the channel status is initially logic "0". Accordingly, the program of Fig. 4 advances to the step 36 through the steps 34 and 35 so that an output signal from the signal processor 6 is recorded into the magnetic tape 9 and that a digital copy of the input digital audio signal is obtained. The step 35 sets a section ID6 of a main ID to logic "10" since both of bit "2" and bit "14" of the channel status are logic "0".

In cases where a digital audio signal is required to be reproduced from a magnetic tape which is a digital copy of a compact disk or a DAT software tape, the recording switch of the operating section 14 is undepressed but the reproducing switch of the operating section 14 is depressed. Accordingly, the program of Fig. 4 advances to the step 41 through the steps 39 and 40 so that the digital audio signal is reproduced from the magnetic tape 9. The step 40 sets bit "2" and bit "14" of a new channel status to logic "0" and logic "1" respectively since the ID6 of the reproduced digital audio signal is logic "10" as understood from the previous description. Accordingly, in the output digital audio signal transmitted via the output terminal 26, bit "2" and bit "14" of the channel status are logic "0" and "1" respectively. If such a digital audio signal is subjected to a digital copying process, the steps 34 and 38 inhibit the actualization of a digital copy since bit "2" and bit "14" of the channel status of the digital audio signal are logic

"0" and "1" respectively.

When recording of an analog audio signal is required, the analog input terminal 1 is subjected to an analog audio signal. In addition, the recording switch of the operating section 14 is depressed and the selection control switch of the operating section 14 is moved to the "analog" position. Accordingly, an output signal from the AD converter 2 is selected and is passed to the signal processor 6 by the switch 5. The program of Fig. 4 advances to the step 36 through the steps 32 and 37 so that an output signal from the signal processor 6 is recorded into the magnetic tape 9. The step 37 sets a section ID6 of a main ID to logic "00". The resulting magnetic tape 9 is referred to as a first-generation tape.

When a first-generation tape is subjected to a reproduction process, both of bit "2" and bit "14" of a new channel status are set to logic "1" by the step 40 of Fig. 4 since the section ID6 of the digital audio signal which is reproduced from the first-generation tape is logic "00". Accordingly, in the output digital audio signal transmitted via the digital output terminal 26, both of bit "2" and bit "14" of the channel status are logic "1". A digital copy of such a digital audio signal is allowed since both of bit "2" and bit "14" of the channel status of the digital audio signal are logic "1". During this copying process, the section ID6 is set to logic "01" by the step 35 of Fig. 4 since both of bit "2" and bit "14" of the channel status of the digital audio signal are logic "1". The magnetic tape 9 which results from this digital copy is referred to as a second-generation tape.

When a second-generation tape is subjected to a reproduction process, both of bit "2" and bit "14" of a subsequent channel status are set to logic "0" by the step 40 of Fig. 4 since the section ID6 of the digital audio signal which is reproduced from the second-generation tape is logic "01". Accordingly, in the output digital audio signal transmitted via the digital output terminal 26, both of bit "2" and bit "14" of the channel status are logic "0". A digital copy of such a digital audio signal is allowed since both of bit "2" and bit "14" of the channel status of the digital audio signal are logic "0". During this copying process, the section ID6 is set to logic "10" by the step 35 of Fig. 4 since both of bit "2" and bit "14" of the channel status of the digital audio signal are logic "0". The magnetic tape 9 which results from this digital copy is referred to as a third-generation tape.

When a third-generation tape is subjected to a reproduction process, bit "2" and bit "14" of a new channel status are set to logic "0" and logic "1" respectively by the step 40 of Fig. 4 since the section ID6 of the digital audio signal which is reproduced from the third-generation tape is logic "10". Accordingly, in the output digital audio signal transmitted via the digital output terminal 26, bit "2" and bit "14" of the channel status are logic "0" and logic "1" respectively. A digital copy of such a digital audio signal is inhibited by the functions of the steps 34 and 38 of Fig. 4 since bit "2" and bit "14" of the channel status of the digital audio signal are logic "0" and logic "1" respectively. In other words, a digital copying process producing a fourth-generation tape is inhibited.

As understood from the previous description, bit "2" and bit "14" of a channel status of a digital audio signal represent a number of digital copy generation of an audio information part of the digital audio signal. Each time the recording and reproduction of the digital audio signal is performed, that is, each time a digital copying process is performed, the number represented by bit "2" and bit "14" of a channel status is incremented. When the number represented by bit "2" and bit "14" of a channel status reaches a predetermined number, a digital copying process will be inhibited.

DESCRIPTION OF THE SECOND PREFERRED EMBODIMENT

A second embodiment of this invention is similar to the embodiment of Figs. 1-4 except that a program controlling a microcomputer 27 (see Fig. 3) differs from the program (see Fig. 4) of the embodiment of Figs. 1-4.

Fig. 5 is a flowchart of a portion of the program in the second embodiment. As shown in Fig. 5, the program advances from a point "A" to a step 136 which determines whether or not a recording switch of an operating section 14 (see Fig. 3) is depressed. When the recording switch is depressed, the program advances to a step 137. When the recording switch is not depressed, the program advances to a step 146.

The step 137 determines whether or not a selection control switch of the operating section 14 is in a "digital" position. When the selection control switch is in the "digital" position, the program advances to a step 138. When the selection control switch is not in the "digital" position, that is, when the selection control switch is in an "analog" position, the program advances to a step 144.

The step 138 controls a switch 5 (see Fig. 3) to select an output signal from a digital demodulator 4 (see Fig. 3). Accordingly, when the selection control switch of the operating section 14 is in the "digital" position, a digital audio signal inputted via a digital input terminal 3 (see Fig. 3) is selected.

A step 139 following the step 138 checks bit "2" of a channel status by referring to an output signal from a channel status decoder 10 (see Fig. 3). When the bit "2" is logic "0" which represents

the inhibition of a digital copy, the program advances to a step 140. When the bit "2" is logic "1" which represents the allowance of a digital copy, the program advances to a step 143.

The step 140 checks a category code, that is, bits "8" to "15" of the channel status by referring to the output signal from the channel status decoder 10. When the category code corresponds to "DAT", that is, when the input digital audio signal is outputted from a DAT system, the program advances to a step 141. When the category code does not correspond to "DAT", the program advances to a step 142.

The step 141 controls a signal processor 6 (see Fig. 3) to inhibit the recording of an output signal from the signal processor 6 into a magnetic tape 9 (see Fig. 3). For example, the inhibition of the signal recording is performed by cutting off the application of the output signal from the signal processor 6 to a recording amplifier 7 (see Fig. 3). Accordingly, when bit "2" of the channel status is logic "0" and also the category code corresponds to "DAT", the recording of the output signal from the signal processor 6 is inhibited. After the step 141, the program advances to a point "B".

The step 144 controls the switch 5 to select an output signal from an AD converter 2 (see Fig. 3). Accordingly, when the selection control switch of the operating section 14 is in the "analog" position, an analog audio signal inputted via an analog input terminal 1 (see Fig. 3) is selected.

A step 145 following the step 144 sets a section ID6 of a main ID to logic "01". After the step 145, the program advances to a step 153.

The step 143 sets the section ID6 of the main ID to logic "00". After the step 143, the program advances to a step 153.

The step 142 sets the section ID6 of the main ID to logic "10". After the step 142, the program advances to a step 153.

In this way, the section ID6 of the main ID is set to logic "01" when an analog audio signal is selected and recorded. The section ID6 is set to logic "00" in the case of a digital copy where bit "2" of the channel status is logic "1" which represents the allowance of the copy. The section ID6 is set to logic "10" in the case of a digital copy where the category of the channel status differs from "DAT".

The step 153 sets a recording mode by which the recording of an output signal from the signal processor 6 into the magnetic tape 9 is enabled. Accordingly, when bit "2" of the channel status is logic "1" or when the category code differs from "DAT", a digital copy is allowed. After the step 153, the program advances to the point "B".

The step 146 determines whether or not a reproducing switch of the operating section 14 is depressed. When the reproducing switch is depressed, the program advances to a step 147. When the reproducing switch is not depressed, the program jumps to the point "B".

A reproducing system including a magnetic head 28 (see Fig. 3) is activated in response to the depression of the recording switch of the operating section 14 in a known way.

The step 147 checks a section ID6 of a main ID of a reproduced digital signal by referring to an output signal from a subcode decoder 21 (see Fig. 3). When the section ID6 differs from logic "00", the program advances to a step 148. When the section ID6 is logic "00", the program advances to a step 151.

The step 148 sets bit "2" of a new channel status to logic "0" which represents the inhibition of a digital copy. After the step 148, the program advances to a step 149.

The step 151 sets bit "2" of a new channel status to logic "1" which represents the allowance of a digital copy. After the step 151, the program advances to a step 152.

The step 149 determines whether or not the section ID6 of the main ID is logic "01". When the section ID6 is logic "01", the program advances to a step 150. When the section ID6 is not logic "01", the program advances to the step 152.

The step 150 sets a category code of a new channel status to a predetermined state, for example, logic "11100000", which is named "DAT-C". The category code "DAT-C" represents that a related digital audio signal is outputted from a DAT system and that a digital copy is allowable regardless of the state of bit "2" of a channel status of the digital audio signal. After the step 150, the program advances to a step 154.

The step 152 sets a category code of a new channel status to logic "11000000" corresponding to "DAT". After the step 152, the program advances to the step 154.

The step 154 outputs the channel status to a channel status encoder 23 (see Fig. 3). The channel status encoder 23 generates a signal representing the channel status of Fig. 1(c) which includes bit "2" given by the step 148 or 151 and also which includes the category code given by the step 150 or 152. A digital modulator 25 (see Fig. 3) generates a digital signal of the format of Fig. 1 in accordance with the output signals from a signal processor 18 (see Fig. 3) and the channel status encoder 23. The digital signal generated by the digital modulator 25 is outputted via a digital output terminal 26 (see Fig. 3). After the step 154, the program advances to the point "B".

General operation of the second embodiment will be described hereinafter. In a digital audio signal reproduced from a compact disk, bit "2" of a

channel status is logic "0" representing the inhibition of digital recording. When such a digital audio signal is required to be digitally copied, the digital input terminal 3 is subjected to the digital audio signal. In addition, the recording switch of the operating section 14 is depressed and the selection control switch of the operating section 14 is moved to the "digital" position. Accordingly, an output signal from the digital demodulator 4 is selected and is passed to the signal processor 6 by the switch 5. Since bit "2" of the channel status is logic "0", the program of Fig. 5 advances from the step 139 to the step 140. In the case of a digital audio signal reproduced from a compact disk, a category code of a channel status is logic "10000000" corresponding to "CD" as shown in Fig. 1(e). Accordingly, the category code differs from "DAT" so that the program of Fig. 5 advances from the step 140 to the step 153 via the step 142. As a result, a digital copy is performed although bit "2" of the channel status represents the inhibition of a digital copy. The step 142 sets the section ID6 of the main ID to logic "10".

In cases where a digital audio signal is required to be reproduced from a magnetic tape which is a digital copy of a compact disk, the recording switch of the operating section 14 is undepressed but the reproducing switch of the operating section 14 is depressed. Accordingly, the program of Fig. 5 advances to the step 147 through the steps 136 and 146. Since the section ID6 is logic "10" as understood from the previous description, the program of Fig. 5 further advances to the step 154 through the steps 148, 149, and 152 so that the digital audio signal is reproduced from the magnetic tape 9. The step 148 sets bit "2" of a new channel status to logic "0" representing the inhibition of a digital copy. The step 152 sets the category code of the channel status to logic "11000000" corresponding to "DAT". Accordingly, in the output digital audio signal transmitted via the digital output terminal 26, bit "2" of the channel status is logic "0" and the category code of the channel status corresponds to "DAT". If such a digital audio signal is subjected to a digital copying process, the steps 139, 140, and 141 of the program of Fig. 5 inhibit the actualization of a digital copy since bit "2" of the channel status is logic "0" and since the category code of the channel status corresponds to "DAT".

In a digital audio signal outputted from a broadcasting satellite tuner, bit "2" of a channel status is logic "1" representing the allowance of a digital copy. When such a digital audio signal is required to be digitally copied, the digital input terminal 3 is subjected to the digital audio signal. In addition, the recording switch of the operating section 14 is depressed and the selection control switch of the operating section 14 is moved to the "digital" position. Accordingly, an output signal from the digital demodulator 4 is selected and is passed to the signal processor 6 by the switch 5. Since bit "2" of the channel status is logic "1", the program of Fig. 5 advances from the step 139 to the step 153 via the step 143. As a result, a digital copy is obtained. The step 143 sets the section ID6 of the main ID to logic "00".

In cases where a digital audio signal whose section ID6 is logic "00" is required to be reproduced from a magnetic tape, the recording switch of the operating section 14 is undepressed but the reproducing switch of the operating section 14 is depressed. Accordingly, the program of Fig. 5 advances to the step 147 through the steps 136 and 146. Since the section ID6 is logic "00", the program of Fig. 5 further advances to the step 154 through the steps 151 and 152 so that the digital audio signal is reproduced from the magnetic tape 9. The step 151 sets bit "2" of a new channel status to logic "1". The step 152 sets a category code of the new channel status to logic "11000000" corresponding to "DAT". Accordingly, in the output digital audio signal transmitted via the digital output terminal 26, bit "2" of the channel status is logic "1" and the category code of the channel status corresponds to "DAT". If such a digital audio signal is subjected to a digital copying process, the steps 139 and 153 of the program of Fig. 5 actualize a digital copy since bit "2" of the channel status is logic "1". In this way, a digital copy of such a digital audio signal is allowed repetitively over many generations.

When recording of an analog audio signal is required, the analog input terminal 1 is subjected to an analog audio signal. In addition, the recording switch of the operating section 14 is depressed and the selection control switch of the operating section 14 is moved to the "analog" position. Accordingly, an output signal from the AD converter 2 is selected and is passed to the signal processor 6 by the switch 5. The program of Fig. 5 advances to the step 153 through the steps 144 and 145 so that an output signal from the signal processor 6 is recorded into the magnetic tape 9. The step 145 sets a section ID6 of a main ID to logic "01". The resulting magnetic tape 9 is referred to as a first-generation tape.

When a first-generation tape is subjected to a reproduction process, the recording switch of the operating section 14 is undepressed but the reproducing switch of the operating section 14 is depressed. Accordingly, the program of Fig. 5 advances to the step 147 through the steps 136 and 146. Since the section ID6 is logic "01", the program of Fig. 5 further advances to the step 154 through the steps 148-150 so that the digital audio

signal is reproduced from the magnetic tape 9. The step 148 sets bit "2" of a new channel status to logic "0" which represents the inhibition of a digital copy. The step 150 sets a category code of the new channel status to "DAT-C". Accordingly, in the output digital audio signal transmitted via the digital output terminal 26, bit "2" of the channel status is logic "0" and the category code of the channel status corresponds to "DAT-C". A digital copy of such a digital audio signal is allowed since the category code of the channel status differs from "DAT" and thus the program of Fig. 5 advances to the step 153 via the steps 140 and 142. The magnetic tape 9 which results from this digital copy is referred to as a second-generation tape. During the copying process which produces a second-generation tape, the step 142 of Fig. 5 sets the section ID6 to logic "10".

When a second-generation tape is subjected to a reproduction process, the recording switch of the operating section 14 is undepressed but the reproducing switch of the operating section 14 is depressed. Accordingly, the program of Fig. 5 advances to the step 147 through the steps 136 and 146. Since the section ID6 is logic "10", the program of Fig. 5 further advances to the step 154 through the steps 148, 149, and 152 so that the digital audio signal is reproduced from the magnetic tape 9. The step 148 sets bit "2" of a new channel status to logic "0" which represents the inhibition of a digital copy. The step 152 sets a category code of the new channel status to logic "11000000" corresponding to "DAT". Accordingly, in the output digital audio signal transmitted via the digital output terminal 26, bit "2" of the channel status is logic "0" and the category code of the channel status corresponds to "DAT". A digital copy of such a digital audio signal is inhibited since bit "2" of the channel status is logic "0" and the category code of the channel status corresponds to "DAT" so that the program of Fig. 5 advances to the step 141 via the steps 139 and 140. In other words, a digital copying process producing a third-generation tape is inhibited.

Claims

1. Method for controlling a recording (31; 136) and reproducing (39; 146) apparatus for a digital signal (3) or a digitized analog signal (1) transmitted between reproducing and recording devices,
wherein,
the signal transmitted being in a first format comprising a copy control signal having a plurality of bits, at least one combination of them representing that a direct copy is to be inhibited and others representing different allowed numbers of generations of copies,
wherein,
the recorded signal being in a second format comprising a copy control subcode signal having a plurality of bits, at least one combination of them representing that a next generation copy is to be inhibited (38; 141) and others representing different allowed numbers of generations of copies,
wherein,
upon recording of the transmitted digital signal the copy control signal is detected to check (34; 139) whether copying is to be allowed (36; 153) or inhibited (38; 141),
wherein,
when direct copying is to be inhibited (38; 141), the recording of the signal is prevented,
wherein,
when direct copying is to be allowed (36; 153), a copying control subcode signal corresponding to the copying control signal associated with the transmitted digital signal is generated (35; 142, 143) , or when a digitized analog signal is to be recorded, a copy control subcode signal in accordance with the original status of the digitized analog signal representing the allowed number of generations of copies is generated (37; 145),
wherein,
the generated copy control subcode signal is recorded (36; 153) together with the digital signal in the second format,
wherein,
upon reproduction (39; 146) the copy control subcode signal is detected and used to generate (40; 148, 150, 151, 152) according to a predetermined sequence, a corresponding new copy control signal, the value of which being different from the value of the copy control signal before copying and representing a reduced allowed number of generations of copies or a copy inhibit status,
wherein,
the reproduced digital signal is combined with the new copy control signal in the first format.

2. A method according to claim 1,
wherein,
the copy control signal contains a copy inhibition bit of a channel status (33; 139) included in the digital signal transmitted between the reproducing and recording devices, representing whether a direct copy of the digital signal is allowed (36; 153) or inhibited (38; 141).

3. A method according to claim 2,
wherein,
the copy control signal contains a category

code which represents which device outputs the digital signal,
wherein,
an input is selected for either direct copying of a digital signal (32; 138) or recording of a digital signal converted from an analog signal (32; 144),
wherein,
the copy control subcode signal is generated in accordance with the category code (34; 140), the input selection information (32; 138, 144) and the information about the presence or absence of the copy inhibition bit (34; 139), and
wherein,
upon reproduction a new category code (40; 150, 152) and a new copy inhibition bit (40; 148; 151) of the new copy control signal are generated.

4. A method according to claim 1 to 3,
wherein,
the copy control subcode signal represents whether a direct copy of an output digital signal, which occurs upon a next reproduction of a copied signal, is allowed unconditionally, whether a direct copy of an output digital signal, which occurs upon a next reproduction of a copied signal, is allowed with conditions that limit a number of digital copy generations, or whether a direct copy of an output digital signal is inhibited unconditionally.

5. A method according to claim 1 to 4,
wherein,
the copy control subcode signal corresponds to a given value (37; 145) when an analog signal is converted into a digital signal and is then recorded and
wherein,
the copy control subcode represents whether a direct copy of an output digital signal, which occurs upon a next reproduction of a copied digital signal is allowed or inhibited,
wherein,
upon reproduction, a copy inhibition bit (40; 151) is attached to an output digital signal in case a given copy control subcode signal is detected (40; 147), and
wherein,
the copy inhibition bit functions to limit directly (34; 139) copying of a digital signal reproduced from a recording medium which is made by converting an analog signal, transmitted between reproducing and recording devices, to a number of direct copy generations.

6. A method according to claim 1 to 5,
wherein,
upon reproduction (146) one of first (152) and second (150) category codes included in the copy control signal are outputed,
wherein,
the first category code (152) determines allowance and inhibition of a digital copy in accordance with presence and absence of a copy inhibition bit, and
wherein,
the second category code (150) allows a digital copy regardless of presence and absence (139) of a copy inhibition bit and
wherein,
the inhibition bit (148) and the second category code (150) are attached to the outut digital signal (154) and
wherein,
the copy inhibition bit (148) functions to limit (139) the number of direct copy generations of a digital signal reproduced from a recording medium which is made by converting an analog signal, transmitted between reproducing and recording devices, to a number of copy generations.

7. A method according to claim 1 to 5,
wherein,
the copy control signal represents a number of digital copy generations of the associated digital information signal,
wherein,
upon reproduction (39) of the digital signal, a new copy control signal representative of a number which equals one plus the number represented by the copy control signal of the received first format signal is generated (40) and the new copy control signal and the reproduced digital signal are combined into a new first format signal and outputted (41), wherein,
upon recording (31), the number represented by the copy control signal of the received first format signal is checked (34) whether to equal or not a predetermined number and
wherein,
the recording of the digital signal of the received first format signal is inhibited (38) when the number represented by the copy control signal of the received first format signal is equal to the predetermined number (34).

8. A method according to claim 6,
wherein,
an identification signal is generated (35) in accordance with the copy control signal of the received first format signal, wherein
the identification signal and the digital signal of

the received first format signal are combined into a second format signal,
wherein,
upon reproduction (39) a new copy control signal on the basis of the identification signal of the reproduced second format signal is generated (40),
wherein,
a number represented by the new copy control signal equals one plus the number represented by the copy control signal of the received first format signal,
wherein,
upon recording (31) a first format signal, the number represented by the copy control signal of the received first format signal is checked (34) whether it is equal to a predetermined number or not and
wherein,
the recording of the digital signal is inhibited (38) when the number represented by the copy control signal is equal to the predetermined number and
wherein,
the recording of the digital signal is allowed (36), when the number represented by the copy control signal of the received first format signal differs from the predetermined number.

9. A method according to claims 1 to 8, adapted to applying to a reproducing apparatus (39; 146).

Patentansprüche

1. Verfahren zur Steuerung eines aufnehmenden (31; 136) und wiedergebenden (39; 146) Gerätes für ein digitales Signal (3) oder ein digitalisiertes analoges Signal (1), das zwischen wiedergebenden und aufnehmendnen Vorrichtungen übertragen wird,
worin
das übertragene Signal in einem ersten Format ist, das ein Kopiersteuersignal mit einer Vielzahl von Bits umfaßt, von denen zumindest eine Kombination darstellt, daß eine direkte Kopie zu verbieten ist und andere verschiedene erlaubte Anzahlen von Generationen von Kopien darstellen,
worin
das aufgenommene Signal in einem zweiten Format ist, das ein Kopiersteuer-Subcode-Signal mit einer Vielzahl von Bits umfaßt, von denen zumindest eine Kombination darstellt, daß eine Kopie nächster Generation zu verbieten ist (38; 141) und andere verschiedene erlaubte Anzahlen von Generationen von Kopien darstellen,
worin,
auf das Aufnehmen des übertragenen digitalen Signals das Kopiersteuersignal nachgewiesen wird, um zu überprüfen (34; 139), ob das Kopieren zu erlauben (36; 153) oder zu verbieten (38; 141) ist,
worin,
wenn das direkte Kopieren zu verbieten ist (38; 141) die Aufnahme des Signals verhindert wird,
worin,
wenn das direkte Kopieren zu erlauben ist (36; 153), ein Kopiersteuer-Subcode-Signal, das dem Kopiersteuersignal entspricht, das zu dem übertragenen digitalen Signal gehört, erzeugt wird (35; 142, 143), oder, wenn ein digitalisiertes analoges Signal aufzunehmen ist, ein Kopiersteuer-Subcode-Signal in Übereinstimmung mit dem Originalstatus des digitalisierten analogen Signals, das die erlaubbare Anzahl von Generationen von Kopien darstellt, erzeugt wird (37; 145),
worin,
das erzeugte Kopiersteuer-Subcode-Signal zusammen mit dem digitalen Signal in dem zweiten Format aufgenommen wird (36; 153),
worin,
auf die Wiedergabe (39; 146) das Kopiersteuer-Subcode-Signal nachgewiesen und verwendet wird, um gemäß einer vorbestimmten Abfolge ein entsprechendes neues Kopiersteuersignal zu erzeugen (40; 148, 150, 151, 152), wobei dessen Wert von dem Wert des Kopiersteuersignals vor dem Kopieren unterschiedlich sein wird und eine verringerte erlaubte Anzahl von Generationen von Kopien oder einen Kopierverbotstatus darstellt,
worin,
das reproduzierte digitale Signal mit dem neuen Kopiersteuersignal in dem ersten Format verknüpft wird.

2. Ein Verfahren nach Anspruch 1,
worin
das Kopiersteuersignal ein Kopierverbotsbit eines Kanalstatus (33; 139) enthält, der in dem digitalen Signal enthalten ist, das zwischen den wiedergebenden und aufnehmenden Vorrichtungen übertragen wird, was darstellt, ob eine direkte Kopie des digitalen Signals erlaubt (36; 153) oder verboten (38; 141) ist.

3. Ein Verfahren nach Anspruch 2,
worin
das Kopiersteuersignal einen Kategoriecode enthält, welcher darstellt, welches Gerät das Digitalsignal ausgibt,
worin

ein Eingang für entweder das direkte Kopieren eines digitalen Signals (32; 138) oder das Aufnehmen eines digitalen Signals, das aus einem analogen Signal (32; 244) gewandelt wurde, ausgewählt wird,
worin
das Kopiersteuer-Subcode-Signal in Übereinstimmung mit dem Kategoriecode (34; 140), der Eingangsauswahlinformation (32;138, 144) und der Information über die Gegenwart oder Abwesenheit des Kopierverbotsbits (34; 139) erzeugt wird, und
worin
auf die Wiedergabe ein neuer Kategoriecode (40; 150, 152) und ein neues Kopierverbotsbit (40; 148, 151) des neuen Kopiersteuersignals erzeugt wird.

4. Ein Verfahren nach Anspruch 1 bis 3,
worin,
das Kopiersteuer-Subcode-Signal darstellt, ob eine direkte Kopie eines digitalen Ausgabesignals, welches auf eine nächste Wiedergabe eines kopierten Signals auftritt, bedingungslos erlaubt ist, ob eine direkt Kopie eines digitalen Ausgabesignals, welches auf eine nächste Wiedergabe eines kopierten Signals auftritt, mit Bedingungen erlaubt ist, die eine Anzahl von digitalen Kopiergenerationen begrenzen, oder ob eine direkte Kopie eines digitalen Ausgabesignals unbedingt verboten ist.

5. Ein Verfahren nach Anspruch 1 bis 4,
worin
das Kopiersteuer-Subcode-Signal einem gegebenen Wert (37; 145) entspricht, wenn ein analoges Signal in ein digitales Signal gewandelt wird und dann aufgenommen wird, und
worin
der Kopiersteuer-Subcode darstellt, ob eine direkte Kopie eines digitalen Ausgabesignals, welches auf eine nächste Wiedergabe eines kopierten digitalen Signals auftritt, erlaubt oder verboten ist,
worin
auf die Wiedergabe, ein Kopierverbotsbit (40; 151) einem digitalen Ausgabesignal im Fall angeheftet wird, daß ein gegebenes Kopiersteuer-Subcode-Signal nachgewiesen wird (40; 147), und
worin
das Kopierverbotsbits wirkt, um das Kopieren eines digitalen Signals, das von einem Aufnahmemedium wiedergegeben wird, welches hergestellt ist, indem ein analoges Signal umgewandelt wird, das zwischen wiedergebenden und aufnehmenden Geräten übertragen wird, auf eine Anzahl von direkten Kopiergenerationen direkt zu beschränken.

6. Ein Verfahren nach Anspruch 1 bis 5,
worin
auf die Wiedergabe (146) einer von ersten (152) und zweiten (150) Kategoriecodes, die in dem Kopiersteuersignal beinhaltet sind, ausgegeben werden,
worin
der erste Kategoriecode (152) die Bewilligung und das Verbot einer digitalen Kopie in Übereinstimmung mit der Gegenwart und Abwesenheit eines Kopierverbotsbits bestimmen, und
worin
der zweite Kategoriecode (150) eine digitale Kopie unabhängig von der Anwesenheit und Abwesenheit (139) eines Kopierverbotsbits erlaubt und
worin das Verbotsbit (148) und der zweite Kategoriecode (150) an das digitale Ausgabesignal (154) angeheftet werden und
worin
das Kopierverbotsbit (148) wirkt, um die Anzahl von direkten Kopiergenerationen eines digitalen Signals, das von einem Aufnahmemedium wiedergegeben wird, welches hergestellt wird, indem ein analoges Signal umgewandelt wird, das zwischen wiedergebenden und aufnehmenden Geräten übertragen wird, auf eine Anzahl von Kopiergenerationen zu beschränken (139).

7. Ein Verfahren nach Anspruch 1 bis 5,
worin
das Kopiersteuersignal eine Anzahl von Digitalkopiergenerationen des zugehörigen digitalen Informationssignals darstellt,
worin
auf die Wiedergabe (39) des digitalen Signals ein neues Kopiersteuersignal, das für eine Anzahl, welche eins plus der Anzahl gleicht, die durch das Kopiersteuersignal des empfangenen ersten Formatsignals dargestellt ist, erzeugt wird (40) und das neue Kopiersteuersignal und das wiedergegebene digitale Signal zu einem neuen ersten Formatsignal verknüpft und ausgegeben (41) werden,
worin,
auf das Aufnehmen (31), die Anzahl, die durch das Kopiersteuersignal des empfangenen ersten Formatsignals dargestellt ist, darauf überprüft wird (34), einer vorbestimmten Anzahl gleich zu sein oder nicht, und
worin
die Aufnahme des digitalen Signals des empfangenen ersten Formatsignals verboten wird (38), wenn die Anzahl, die durch das Kopiersteuersignal des empfangenen ersten Format-

signals gleich der vorbestimmten Anzahl ist (34).

8. Ein Verfahren nach Anspruch 6,
worin
ein Identifizierungssignal in Übereinstimmung mit dem Kopiersteuersignal des empfangenen ersten Formatsignals erzeugt wird (35), worin
das Identifizierungssignal und das digitale Signal des empfangenen ersten Formatsignals zu einem zweiten Formatsignal verknüpft werden,
worin
auf die Wiedergabe (39) ein neues Kopiersteuersignal auf der Grundlage des Identifizierungssignals des wiedergegebenen zweiten Formatsignals erzeugt wird (40), worin eine Anzahl, die durch das neue Kopiersteuersignal dargestellt ist, eins plus der Anzahl gleicht, die durch das Kopiersteuersignal des empfangenen ersten Formatsignals dargestellt wird,
worin
auf das Aufnehmen (31) eines ersten Formatsignals die Anzahl, die durch das Kopiersteuersignal des empfangenen ersten Formatsignals darauf überprüft wird (34), ob es einer vorbestimmten Anzahl gleich ist oder nicht, und
worin
das Aufnehmen des digitalen Signals verboten wird (38), wenn die Anzahl, die durch das Kopiersteuersignal dargestellt wird, der vorbestimmten Anzahl gleich ist und worin
das Aufnehmen des digitalen Signals bewilligt wird (36), wenn die Anzahl, die durch das Kopiersteuersignal des empfangenen ersten Formatsignals sich von der vorbestimmten Anzahl unterscheidet.

9. Ein Verfahren nach Anspruch 1 bis 8,
daß dazu angepaßt ist, an eine Wiedergabevorrichtung (39; 146) angelegt zu werden.

Revendications

1. Procédé de commande d'un appareil d'enregistrement (31; 136) et de reproduction (39; 146) d'un signal numérique (3) ou d'un signal analogique numérisé (1) transmis entre des dispositifs de reproduction et d'enregistrement,
dans lequel le signal transmis est dans un premier format et comprend un signal de maîtrise des copies avec une pluralité de bits, au moins une combinaison de ceux-ci représentant le fait qu'une copie directe doit être interdite et d'autres représentant différents nombres autorisés de créations de copies,
dans lequel le signal enregistré est dans un second format et comprend un signal de sous code de maîtrise de copies avec une pluralité de bits, au moins une combinaison de ceux-ci représentant le fait qu'une prochaine production de copies doit être interdite (38; 141) et d'autres représentant différents nombres autorisés de créations de copies,
dans lequel, lors de l'enregistrement du signal numérique transmis, le signal de maîtrise de copies est détecté pour vérifier (34; 139) si le copiage doit être autorisé (36; 153) ou interdit (38; 141),
dans lequel, lorsqu'un copiage direct doit être interdit (38; 141), l'enregistrement du signal est empêché,
dans lequel, lorsqu'un copiage direct doit être autorisé (35; 153), un signal de sous code de maîtrise du copiage correspondant au signal de maîtrise du copiage associé au signal numérique transmis est produit (35; 142, 143) ou bien, quand on doit enregistrer un signal analogique numérisé, un signal de sous code de maîtrise de copies conforme à l'état de départ du signal analogique numérisé représentant le nombre autorisé, de créations de copies est généré (37; 145),
dans lequel le signal de sous code de maîtrise de copies généré est enregistré (36; 153) en même temps que le signal numérique dans le second format,
dans lequel, lors de la reproduction (39; 146) , le signal de sous code de maîtrise de copies est détecté et utilisé pour générer (40; 148, 150, 151, 152), selon une séquence prédéterminée, un nouveau signal de maîtrise de copies correspondant dont la valeur diffère de la valeur du signal de maîtrise de copies avant copiage et représente le nombre réduit autorisé de créations de copies ou un état d'interdiction de copie,
dans lequel le signal numérique reproduit est combiné avec le nouveau signal de maîtrise de copies dans le premier format.

2. Procédé selon la revendication 1,
dans lequel le signal de maîtrise de copies contient un bit d'interdiction de copie d'un état de canal (33; 139) inclus dans le signal numérique transmis entre les dispositifs de reproduction et d'enregistrement, qui représente le fait qu'une copie directe du signal numérique est autorisée (36; 153) ou interdite (38; 141).

3. Procédé selon la revendication 2,
dans lequel le signal de maîtrise de copies contient un code de catégorie qui représente le dispositif qui émet le signal numérique,
dans lequel une entrée est sélectionnée soit pour un copiage direct d'un signal numéri-

que (32; 138) soit pour un enregistrement d'un signal numérique converti à partir d'un signal analogique (32; 144),

dans lequel le signal de sous code de maîtrise de copies est généré d'après le code de catégorie (34; 140), l'information (32; 138, 144) de sélection d'entrée et l'information sur la présence ou l'absence du bit (34; 139) d'interdiction de copie, et

dans lequel, lors de la reproduction, un nouveau code de catégorie (40; 150, 152) et un nouveau bit d'interdiction de copie (40; 148; 151) du nouveau signal de maîtrise de copies sont produits.

4. Procédé selon la revendication 1 à 3,

dans lequel le signal de sous code de maîtrise de copies représente si une copie directe d'un signal numérique de sortie, qui se produit lors de la prochaine reproduction d'un signal copié, est autorisée sans condition, si une copie directe d'un signal numérique de sortie qui se produit lors de la prochaine reproduction d'un signal copié est autorisée dans des conditions qui limitent le nombre de copies numériques créées ou si une copie directe d'un signal numérique de sortie est interdite sans condition.

5. Procédé selon les revendications 1 à 4,

dans lequel le signal de sous code de maîtrise de copies correspond à une valeur donnée (37; 145) quand un signal analogique est converti en un signal numérique puis enenregistré, et

dans lequel le signal de sous code de maîtrise de copies représente si une copie directe d'un signal numérique de sortie, qui se produit lors de la prochaine reproduction d'un signal numérique copié, est autorisée ou interdite,

dans lequel, lors d'une reproduction, un bit d'interdiction de copie (40; 151) est fixé à un signal numérique de sortie dans le cas où un signal de sous code de maîtrise de copies donné est détecté (40; 147), et

dans lequel le bit d'interdiction de copie fonctionne pour limiter directement (34; 139) le copiage d'un signal numérique reproduit à partir d'un milieu d'enregistrement, qui est obtenu par conversion d'un signal analogique, transmis entre des dispositifs de reproduction et d'enregistrement, en un certain nombre de créations de copies directes.

6. Procédé selon les revendications 1 à 5,

dans lequel, lors d'une reproduction (146), l'un des premier (152) et second (150) codes de catégorie inclus dans le signal de maîtrise de copie est émis,

dans lequel le premier code de catégorie (152) détermine l'autorisation ou l'interdiction d'une copie numérique d'après la présence ou l'absence d'un bit d'interdiction de copie,

dans lequel le second code de catégorie (150) autorise une copie numérique qu'un bit d'interdiction de copie soit présent ou absent (139),

dans lequel le bit d'interdiction (148) et le second code de catégorie (150) sont fixés au signal numérique de sortie (154), et

dans lequel le bit d'interdiction de copie (148) fonctionne pour limiter (139) le nombre de créations de copies directes d'un signal numérique reproduit depuis un support d'enregistrement, qui est obtenu par conversion d'un signal analogique, transmis entre des dispositifs d'enregistrement et de reproduction, en un certain nombre de créations de copies.

7. Procédé selon les revendications 1 à 5,

dans lequel le signal de maîtrise de copies représente un certain nombre de créations de copies numériques du signal d'information numérique associé,

dans lequel, lors d'une reproduction (39) du signal numérique, un nouveau signal de maîtrise de copies représentant un nombre qui est égal à un plus le nombre représenté par le signal de maîtrise de copies du signal de premier format reçu est produit (40) et le nouveau signal de maîtrise de copies ainsi que le signal numérique reproduit sont combinés pour donner un nouveau signal de premier format et émis (41),

dans lequel, lors d'un enregistrement (31), le nombre représenté par le signal de maîtrise de copies du signal de premier format reçu est vérifié (34) pour voir s'il est égal ou non à un nombre prédéterminé, et

dans lequel l'enregistrement du signal numérique du signal de premier format reçu est interdit (38) quand le nombre représenté par le signal de maîtrise de copies du signal de premier format reçu est égal au nombre prédéterminé (34).

8. Procédé selon la revendication 6,

dans lequel un signal d'identification est produit (35) d'après le signal de maîtrise de copies du signal de premier format reçu,

dans lequel le signal d'identification et le signal numérique du signal de premier format reçu sont combinés pour donner un signal de second format,

dans lequel, lors d'une reproduction (39),

un nouveau signal de maîtrise de copies est produit (40) sur la base du signal d'identification du signal de second format reproduit,

dans lequel un nombre représenté par le nouveau signal de maîtrise de copies est égal à un plus le nombre représenté par le signal de maîtrise de copies du signal de premier format reçu,

dans lequel, lors d'un enregistrement (31) d'un signal de premier format, le nombre représenté par le signal de maîtrise de copies du signal de premier format reçu est vérifié (34) pour voir s'il est égal à un nombre prédéterminé ou non,

dans lequel l'enregistrement du signal numérique est interdit (38) quand le nombre représenté par le signal de maîtrise de copies est égal au nombre prédéterminé, et

dans lequel l'enregistrement du signal numérique est autorisé (36) quand le nombre représenté par le signal de maîtrise de copies du signal de premier format reçu est différent du nombre prédéterminé.

9. Procédé selon les revendications 1 à 8, apte à être appliqué à un appareil de reproduction (39; 146).

FIG. 1

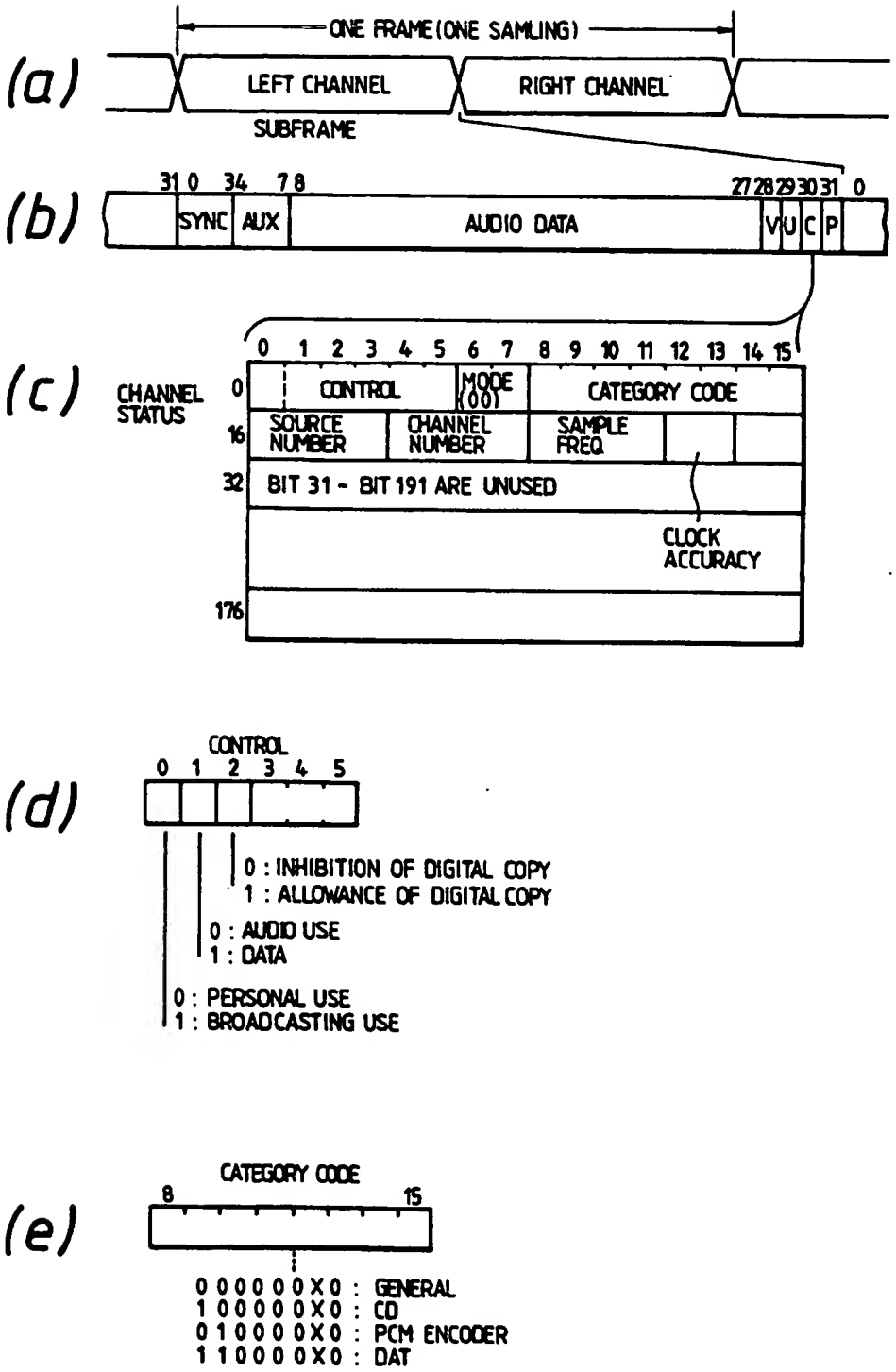
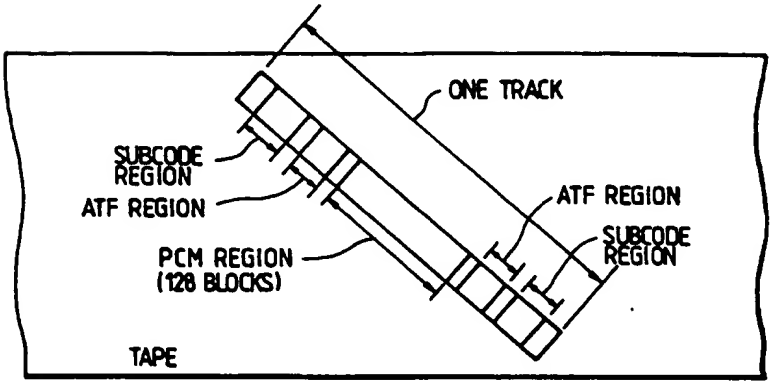
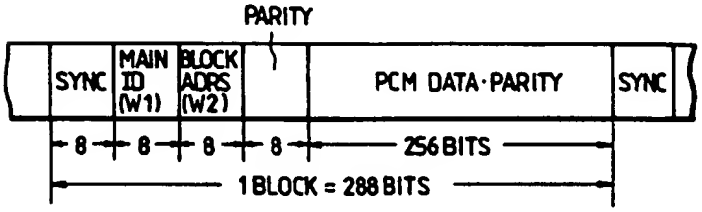

(a)
ONE FRAME(ONE SAMLING)
LEFT CHANNEL
RIGHT CHANNEL
SUBFRAME
(b)
31 0 34 7 8
27 28 29 30 31 0
SYNC
AUX
AUDIO DATA
V U C P
(c)
CHANNEL STATUS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0
CONTROL
MODE (00)
CATEGORY CODE
16
SOURCE NUMBER
CHANNEL NUMBER
SAMPLE FREQ.
32
BIT 31 - BIT 191 ARE UNUSED
CLOCK ACCURACY
176
(d)
CONTROL
0 1 2 3 4 5
0 : INHIBITION OF DIGITAL COPY
1 : ALLOWANCE OF DIGITAL COPY
0 : AUDIO USE
1 : DATA
0 : PERSONAL USE
1 : BROADCASTING USE
(e)
CATEGORY CODE
8 15
0 0 0 0 0 0 X 0 : GENERAL
1 0 0 0 0 0 X 0 : CD
0 1 0 0 0 0 X 0 : PCM ENCODER
1 1 0 0 0 0 X 0 : DAT

FIG. 2

(a)



(b)



(c)

MAIN ID (W1)			BLOCK ADRS (W2)
FMT ID	ID 1	FRAME ADRS	0 X X X X 0 0 0
OPTIONAL CODE			0 0 0 1
ID 2	ID 3	FRAME ADRS	0 0 1 0
OPTIONAL CODE			0 0 1 1
ID 4	ID 5	FRAME ADRS	0 1 0 0
OPTIONAL CODE			0 1 0 1
ID 6	ID 7	FRAME ADRS	0 1 1 0
OPTIONAL CODE			0 1 1 1

(d)

FMT ID

0 0 : AUDIO USE

ID 6

0 0 : ALLOWANCE OF DIGITAL COPY
1 0 : INHIBITION OF DIGITAL COPY
01, 11 : ALLOWANCE OF DIGITAL COPY

FIG. 3

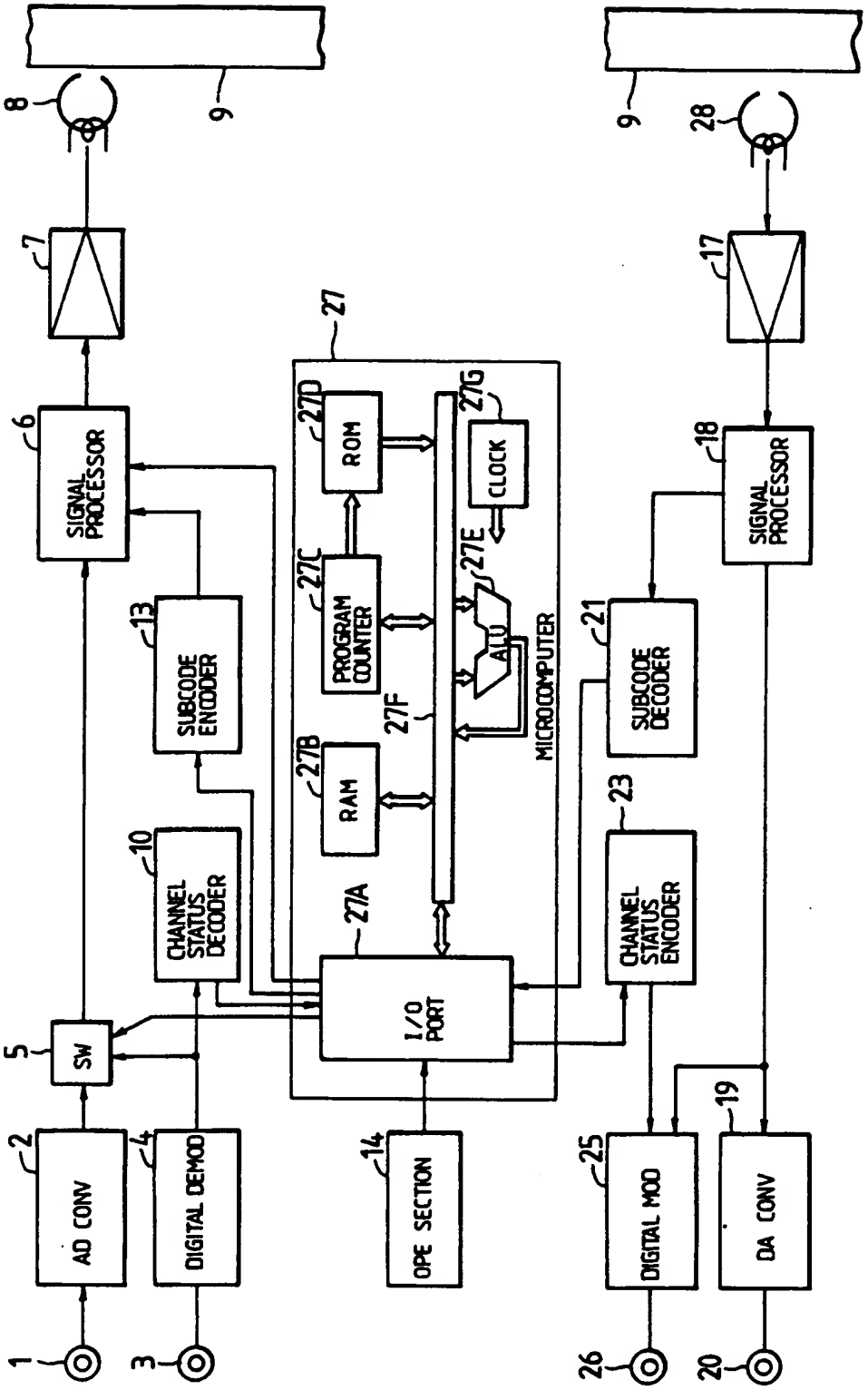

1
2
AD CONV
3
4
DIGITAL DEMOD
5
SW
6
SIGNAL PROCESSOR
7
8
9
10
CHANNEL STATUS DECODER
13
SUBCODE ENCODER
14
OPE SECTION
17
18
SIGNAL PROCESSOR
19
DA CONV
20
21
SUBCODE DECODER
23
CHANNEL STATUS ENCODER
25
DIGITAL MOD
26
28
27
MICROCOMPUTER
27A
I/O PORT
27B
RAM
27C
PROGRAM COUNTER
27D
ROM
27E
ALU
27F
27G
CLOCK

FIG. 4

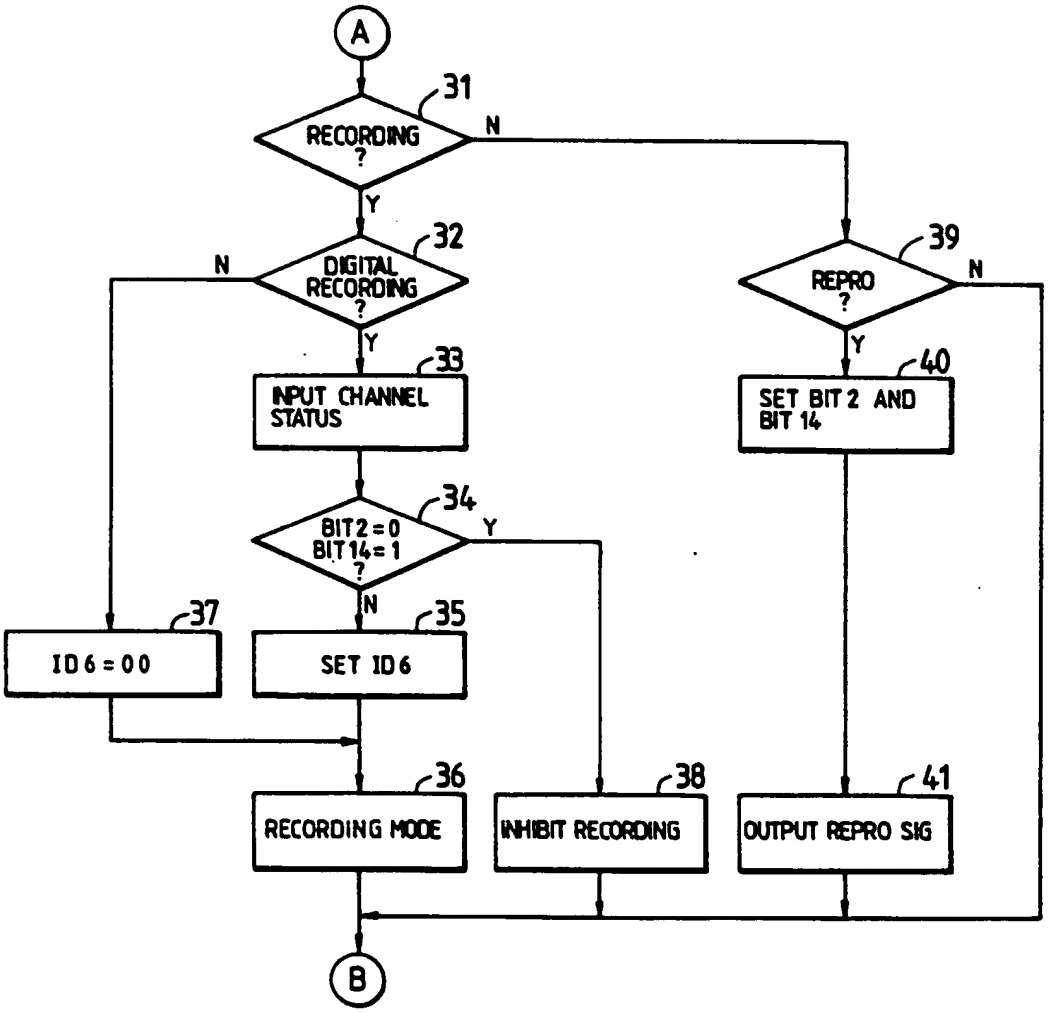
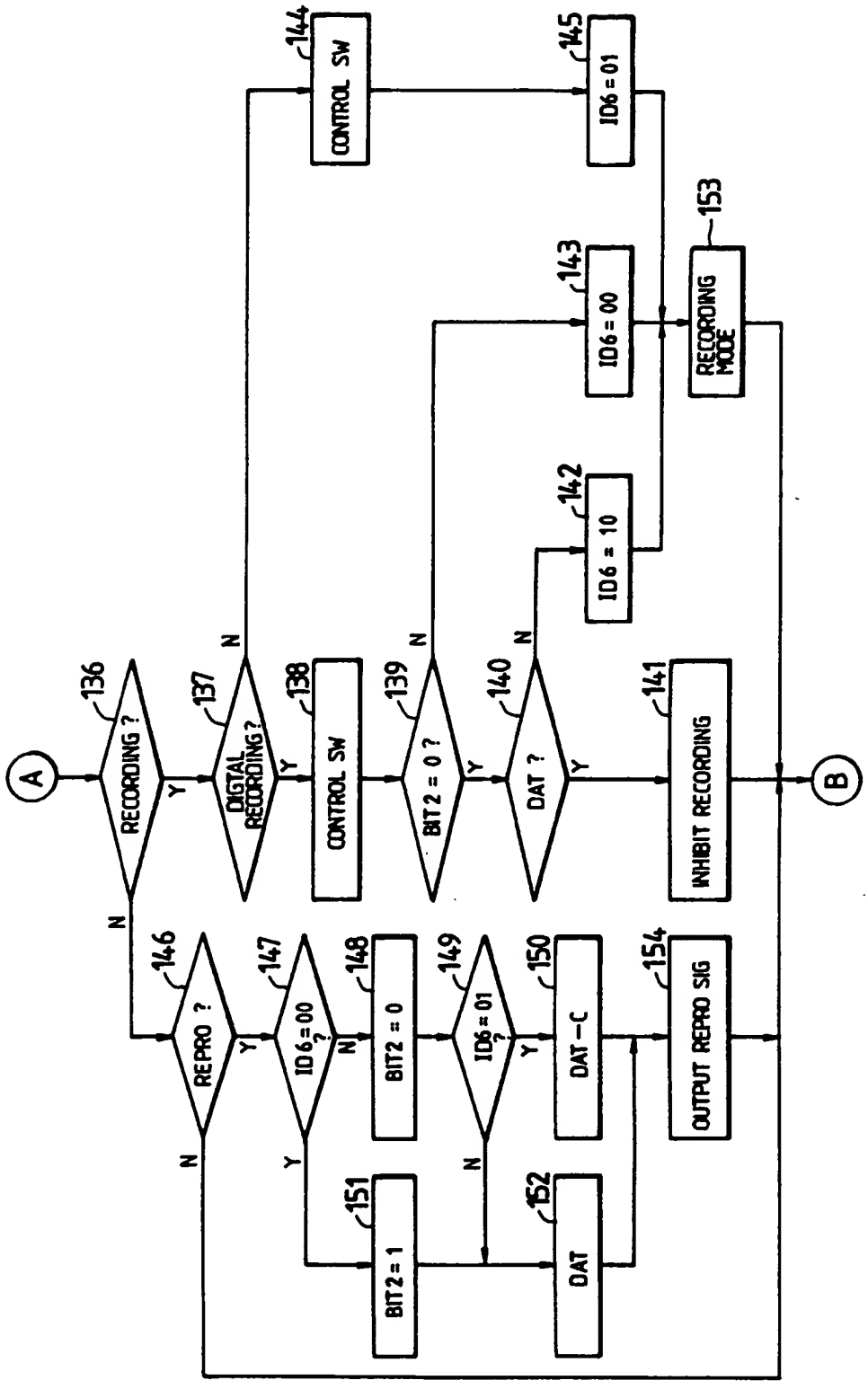

A
31
RECORDING ?
N
Y
32
DIGITAL RECORDING ?
N
Y
33
INPUT CHANNEL STATUS
34
BIT2=0 BIT14=1 ?
Y
N
37
ID6=00
35
SET ID6
36
RECORDING MODE
38
INHIBIT RECORDING
39
REPRO ?
N
Y
40
SET BIT2 AND BIT 14
41
OUTPUT REPRO SIG
B

FIG. 5


A
136
RECORDING ?
Y
N
137
DIGITAL RECORDING ?
Y
N
138
CONTROL SW
144
CONTROL SW
139
BIT 2 = 0 ?
Y
N
140
DAT ?
Y
N
141
INHIBIT RECORDING
B
142
ID6 = 10
143
ID6 = 00
145
ID6 = 01
153
RECORDING MODE
146
REPRO ?
Y
N
147
ID6 = 00 ?
Y
N
148
BIT2 = 0
149
ID6 = 01 ?
Y
N
150
DAT — C
154
OUTPUT REPRO SIG
151
BIT2 = 1
152
DAT